

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

David BAILEY et al

Serial No.: To be assigned (National Phase of PCT/AU00/00669)

Filed: December 14, 2001

For: CATHODE PLATE

NOTICE OF CLAIM FOR PRIORITY

Honorable Commissioner of
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Sir:

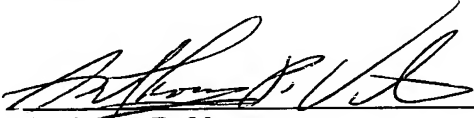
The benefit of the filing date of the following prior foreign application filed in the following foreign country is hereby requested for the above-identified application and the priority provided in 35 USC 119 is hereby claimed:

Australian Provisional Patent Application No. PQ 1066, Filed June 18, 1999

It is requested that the file of this application be marked to indicate that the requirements of 35 USC 119 have been fulfilled and that the Patent and Trademark Office kindly acknowledge receipt of this document.

Respectfully submitted,

Date: Dec. 14, 2001

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I, ANNA MAIJA EVERETT, ACTING TEAM LEADER EXAMINATION
SUPPORT & SALES hereby certify that annexed is a true copy of the
Provisional specification in connection with Application No. PQ 1066 for a
patent by COPPER REFINERIES PTY LTD filed on 18 June 1999.

WITNESS my hand this
Twenty-ninth day of June 2000

A. M. Everett

ANNA MAIJA EVERETT
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AUSTRALIA

PATENTS ACT 1990

PROVISIONAL SPECIFICATION

FOR THE INVENTION ENTITLED:-

"CATHODE PLATE"

The invention is described in the following statement:-

TECHNICAL FIELD

The present invention relates to a cathode plate for use in electro-deposition of metal.

BACKGROUND ART

5 There are various processes and apparatus for electro-refining or electro-winning metal.

One particularly successful process for electro-depositing of copper for example is the so-called ISA PROCESS in which copper is deposited on a stainless steel cathode mother plate. The electrolytically deposited copper is then stripped from the cathode by
10 first flexing the cathode to cause at least a part of the copper deposit to separate from the cathode and then wedge stripping or gas blasting the remainder of the copper from the cathode.

In the ISA PROCESS the bottom edge of the cathode mother plate is generally covered with a release compound such as wax or a plastic edge strip to prevent
15 deposition of copper thereon. This allows for removal of the electro-deposited copper as substantially equivalent separate sheets from both sides of the cathode plate. Such waxing of the cathode sheet, however, is time consuming and there is added cost both for applying the wax and for recovering the wax from the stripping process and associated housekeeping.

20 To avoid these difficulties, some electro-refining/electro-winning operations use a so-called enveloped cathode process. In such a process the lower edge of the cathode sheet is not waxed and the electro-deposited metal is allowed to grow on both sides of the sheet and around the bottom edge of the cathode mother plate.

Removal of the electrolytically deposited envelope of metal is then accomplished by flexing the cathode and pulling back the metal from both sides of the sheet so that it forms a V. The cathode mother plate is then removed from between the electrolytically deposited envelope of metal, the envelope is then closed and rotated from its vertical position to a horizontal position and transported to a stacking/bundling station.

Not only does such a removal process require complex apparatus for opening the metal envelope, removing the cathode mother plate prior to closing of the envelope and rotating the envelope from the vertical to the horizontal position for stacking, such an arrangement is time consuming and generally not as quick as the ISA PROCESS stripping step.

The applicant has developed a new process in which an envelope of metal is formed on the stainless steel cathode mother plate and then stripped into two separate sheets. The new process will be discussed with reference to figures 1a-1d and 2a-2d attached herewith.

The initial step in stripping an electrolytically deposited metal envelope from its cathode mother sheet is to at least partially separate either side of the deposited envelope from the cathode sheet. In this regard reference is made to figures 1A-1D. The enveloped cathode comprises cathode sheets 20 and 30 deposited on the cathode mother sheet 10 and joined along the lower edge thereof by a frangible portion 40. The cathode mother sheet is firstly flexed to provide separation of at least the upper end portion 50 of the sheets 20, 30.

The partially separated envelope as shown in figure 1D is then subjected to a stripping operation as shown in figures 2A and 2B. The partially separated sheets 20

and 30 are positioned in a stripping apparatus on rollers or conveyor belt 50. The apparatus includes a wedge stripper or air blaster 130. These wedge strippers 130 enter the gap between sheets 20, 30 and cathode mother sheet 10. The wedge strippers 130 essentially separate the entire sheet portions 20 and 30 of the electro-deposited envelope from the cathode mother sheet 10. The sheets 20 and 30, however, are still held together by the frangible portion 40 extending along the bottom edge of the cathode sheet 10 as shown in Figure 2B. To effect full separation of the electro-deposited metal envelope from the cathode mother sheet 10 into separate substantially equivalent sheets 20 and 30 is held by grippers 25, 35 and rotated about the frangible portion 40 from the substantial vertical position shown in figure 2B to the substantially horizontal position shown in figure 2C. This rotation separates the deposited metal from the cathode into two substantially equivalent sheets. In many cases, a single rotation of the sheets 20, 30 from the vertical to the horizontal is all that is required to separate the sheets. This separation of the sheets 20 and 30 from each other as well as the cathode mother plate may be confirmed by the grippers 25, 35 as follows. The grippers which still hold the sheet 20, 30 in the horizontal position shown in figure 2C, are adapted to pull the respective sheets slightly outward as shown in figure 2D. If the sheets, 20, 30 move outwardly in unison with the grippers, separation of the sheets 20, 30 is confirmed. If, however, the force to move the grippers outward is too great or simply the grippers do not move this indicates that the frangible portion 40 has not in fact separated the sheets 20, 30 and accordingly further rotation (as shown in figure 2C) of the sheets may be required.

If further manipulation/rotation of sheets 20, 30 is required, the apparatus using grippers 25 and 35 rotates sheets 20 and 30 upwardly and downwardly until the aforementioned confirmation of separation of the sheets is effected.

5 In a preferred embodiment, cathode sheet 10 may be lifted upwardly in the stripping apparatus to provide more clearance between it and the sheets 20, 30 and frangible portion 40 since manipulation of the sheets 20 and 30 may cause contact between at least the frangible portion 40 and the cathode sheet 10.

Once the cathode sheets 20 and 30 are separated into substantially equivalent separate sheets, it is a simple matter to transport the sheets out of the apparatus for
10 stacking and subsequent treatment.

In some cases it is quite difficult to separate the envelope of deposited metal into two separate sheets. As will be appreciated, repeated rotation or flapping of the sheet portions can be quite time consuming and reduces the overall efficiency of the process.

It is an object of the present invention to overcome or ameliorate at least one of
15 the disadvantages of the prior art, or to provide a useful alternative.

DISCLOSURE OF THE INVENTION

In a first aspect, the present invention provides a method of electro-depositing an envelope of metal on a cathode said envelope having deposited metal on either side of said cathode and joined along at least one edge portion by a frangible region, said metal
20 being removable from said cathode by rotation of respective sides of the deposited metal envelope about the frangible portion to separate the deposited metal from the cathode into two substantially equivalent sheets,

wherein a V-groove is provided in the frangible region, said groove being shaped such that during said electro-deposition of metal a line of weakness is formed within the arc of the V.

In a preferred embodiment the arc of the V-groove is between 75 and 105 degrees
5 and most preferably the arc of the V-groove is substantially 90 degrees.

The present applicant has determined that the shape of the V-groove in the cathode mother plate has an impact on the ability to separate the deposited metal envelope from the cathode into two substantially equivalent sheets.

By appropriate sizing and shaping of the V-groove, it is possible to reliably
10 provide a line of weakness between the two sides of the electro-deposited envelope. If this line of weakness is not formed within the arc of the V-groove, the separation of the metal envelope into two separate sheets may be difficult and indeed when separation does occur it can be outside the immediate vicinity of the frangible region.

For instance, if the line of weakness is not formed within the arc of the V-groove, a
15 fracture line, that is the line of separation of the sheets, may extend outside the V-groove and in some cases may continue round the end of the plate to an exterior side of the cathode mother plate. The sheets may then fracture at a point outside the frangible region i.e. preferably along the lower end of the mother plate. Having such a line of fracture outside the frangible region creates difficulties in the stripping process. In some
20 instances it may be necessary to rotate or flap the sheets several times to separate the sheets. Further, having a line of fracture outside the frangible region will produce two sheets which are not substantially equivalent in size. One sheet may be essentially flat

with another sheet having a small lip or hooked edge as shown for example in Figure 3 discussed below.

Clearly this is undesirable. Rotating or flapping the sheets several times increases the residence time of the plate in the stripping machine and thereby slows production.

5 Further, the resulting sheets with uneven edges etc are unsightly and difficult to handle.

The applicant has found the shape of the V-groove can be altered so that the line of weakness extending between the two sheets remains in the arc of V-groove. The shape of the V-groove is a balance between allowing growth of the deposited metal in the V-groove while still permitting easy separation of the two sheets.

10 In another aspect, the present invention provides a cathode plate for electro-deposition of an envelope of metal, said cathode plate having a V-groove provided along its lower most edge, said groove being shaped such that during electro-deposition of metal, a line of weakness is formed within the arc of the V.

Unless the context clearly requires otherwise, throughout the description and the
15 claims, the words 'comprise', 'comprising', and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to".

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described by way of example only with
20 reference to the accompanying drawings in which:

Figures 1A-2D are end elevational views of the process for stripping electro-deposited metal envelopes as developed by the applicant and are included for clarification purposes only.

Figure 3 is an end elevational view of a cathode mother plate with a deposited metal envelope partially stripped into two separate sheets,

Figure 4 is an end elevational view of an embodiment of the present invention,

Figures 5 and 6 are end elevational views showing different shape of V-grooves in
5 the cathode plate, and

MODE(S) FOR CARRYING OUT THE INVENTION

Figures 1A-2D are discussed above.

Turning again to Figure 3, as discussed above, if the V-groove 15 in the cathode mother plate 10 is not of an appropriate size and shape, when the deposited metal
10 envelope is stripped from the mother plate 10 into two separate sheets 20 and 30, they may not separate into two substantially equivalent sheets. In the drawings shown, sheet 20 has a lip 25 which extends around almost the entire end portion of the mother plate 10. The fracture line 35 between the metal sheet 20 and 30 is essentially on one side of the cathode mother plate 10 rather than being in the preferred frangible region 40 at the
15 lower end of the mother plate.

The applicants have found that it is possible to tailor the V-groove in the lower end of the mother plate such that a line of weakness is formed in the arc of the V-groove to thereby permit reliable fracture of the deposited metal envelope into two substantially equivalent sheets.

20 Reference is made to Figure 4 which shows cathode mother plate 100 with a V-groove 150 formed along its lower end edge. For the sake of simplicity, the arc of groove 150 shown in Figure 4 is 90 degrees, however, as will be appreciated from the foregoing it is not essential that the arc of the V-groove equal 90 degrees.

The shape and size of V-groove 150 is designed to perform several functions. Its primary function is to permit separation of the deposited metal envelope 120 from the mother plate 100 into two substantially equivalent sheets 122 and 124.

How the V-groove provides this function will now be explained. As will be clear to persons skilled in the art, when the mother plate 100 is placed in a cell for, say, electro-refining of copper, it is interspersed between copper anodes and substantially immerses in an electrolytic solution. The copper from the anodes enters the electrolyte for redepositing on the copper cathode. Generally, to provide a "full term" deposit the cathode remains in the electrolyte bath between 5 and 14 days.

When the copper crystals are deposited on the metal cathode, they are deposited at substantially right angles to the deposition surface as shown by arrows in Figure 4. Generally, the copper will take the path of least resistance and endeavour to deposit on the cathode as quickly as possible. Accordingly, it will be appreciated that it is easier for the copper to deposit on the exterior side surfaces 102, 104 of the cathode plate 100 rather than in the V-groove 150. It is important, however, that copper is deposited in the V-groove since when the copper envelope is removed from mother plate 100, by pulling on the opposite sides of the metal envelope as discussed above, fracture or crack initiation begins in the frangible region 140 at the lower end of the mother plate 100. It is desirable that this crack initiation begins at the apex of V-groove 150. Accordingly, it is important that V-groove 150 is shaped to allow deposition of copper in the V-groove such that the line of weakness extends between the arc of the V-groove 150.

The applicants have found that a V-groove with an arc of $90^\circ \pm 15^\circ$ allows such growth of copper in the V-groove while providing a line of weakness as shown by dotted

line A between the arc of the V-groove. When the deposited metal envelope is then removed, the position of line of weakness A in the V-groove causes the metal to split along a fracture line in the frangible region 140 into two substantially equivalent sheets.

The V-groove shown in Figure 4 can be compared with the V-groove shown in the
5 Figures 5 and 6.

In Figure 5, a shallow V-groove 60 is shown. The shape of this V-groove 60 does not provide as great a resistance to deposition of copper as does groove 150 shown in Figure 4. Accordingly, copper is deposited quite readily in V-groove 60. However, the applicants have found that due to shape of groove 60, the length and hence effectiveness
10 of the line of weakness is reduced. Thus forming a stronger bond between the two sides of the metal envelope making it more difficult to split the metal envelope into two substantially equivalent sheets. Indeed, experimental trials have shown that several cycles of rotation or flapping in the stripping machine may be required to separate such sheets and in some cases they can split in a manner similar to that shown in Figure 3.

15 In Figure 6, the groove 70 is narrower and deeper. This creates a greater resistance to deposition of copper ions that enter V-groove 150 of Figure 4 or V-groove 60 of Figure 5. In some cases, copper will not deposit throughout V-groove 70 and particularly not near the apex of the V-groove. This causes a bridging 80 of metal across the V-groove. Once again, this bridging of metal across the V-groove does not provide
20 the desired line of weakness in the arc of the V-groove. The bridge 80 can act to strongly bind the two sides of the metal envelope which once again must be rotated or flapped several times to separate.

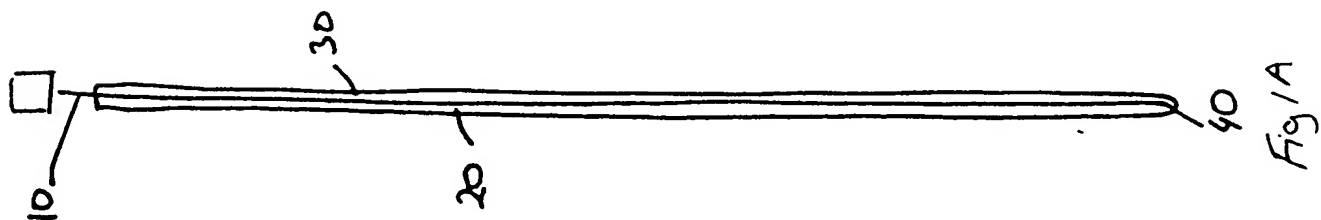
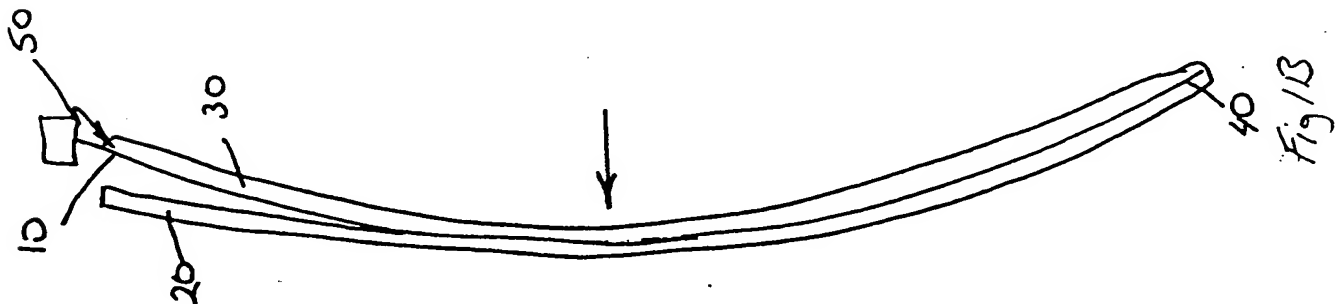
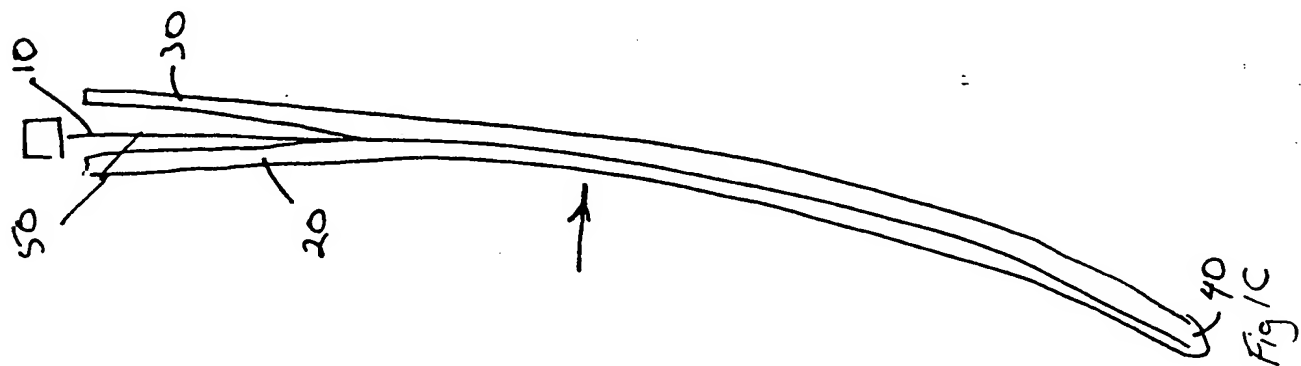
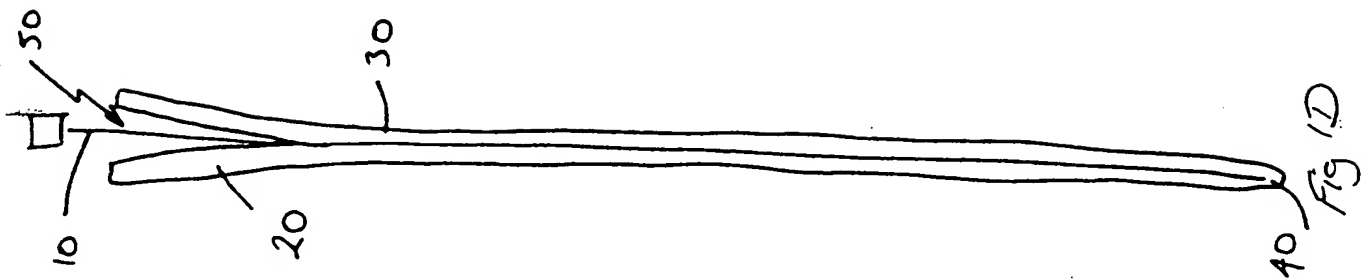
In another embodiment of the present invention, which is particularly suitable for electro winning processes, the V-groove can be sized and shaped to trap gaseous material which ~~further acts to define a line of weakness in the arc of the groove.~~

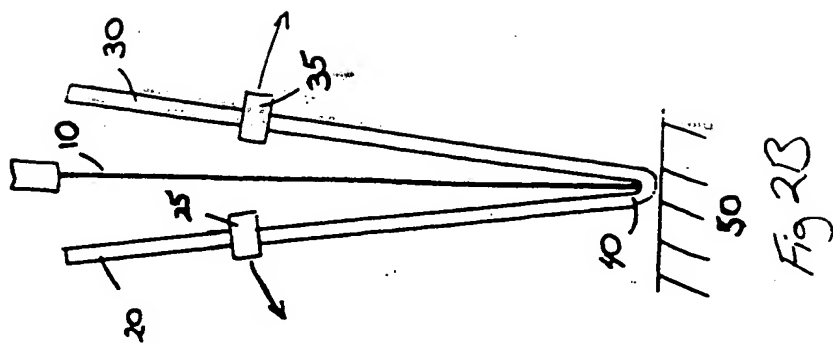
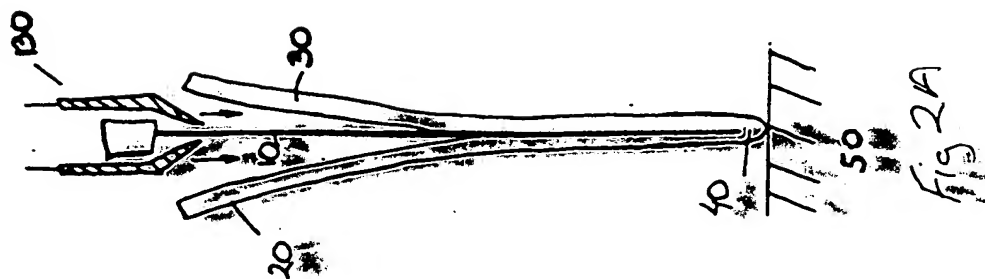
It will be appreciated that variations may be made to the process and apparatus
5 described herein without parting from the spirit or scope of the present invention.

DATED this 18th Day of June 1999

COPPER REFINERIES PTY LIMITED

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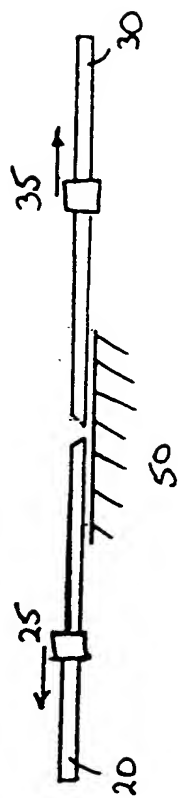
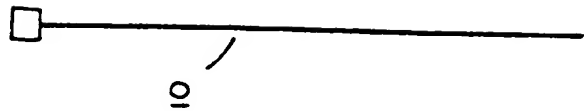


Fig 2D

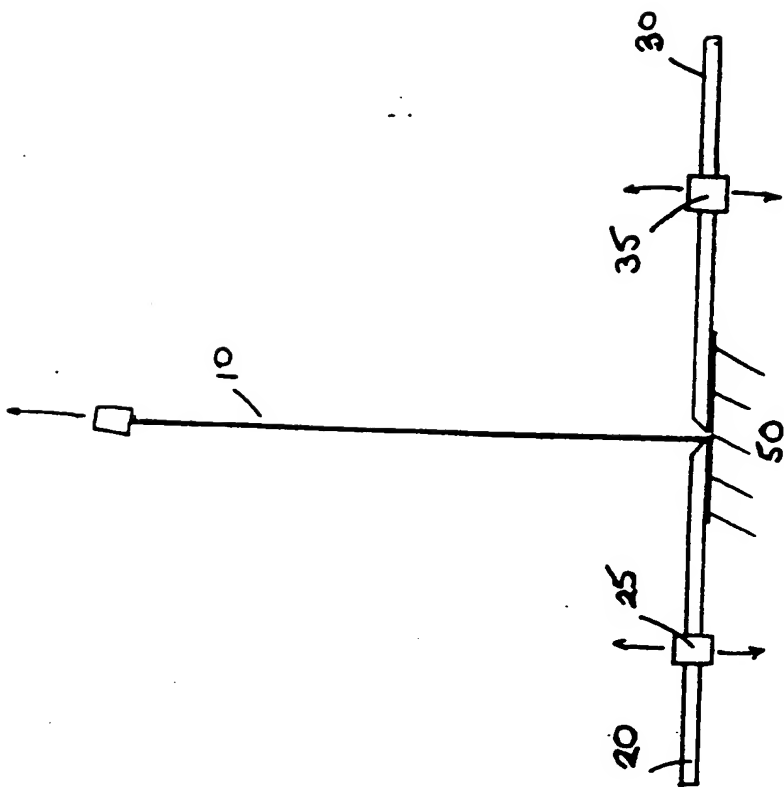


Fig 2C

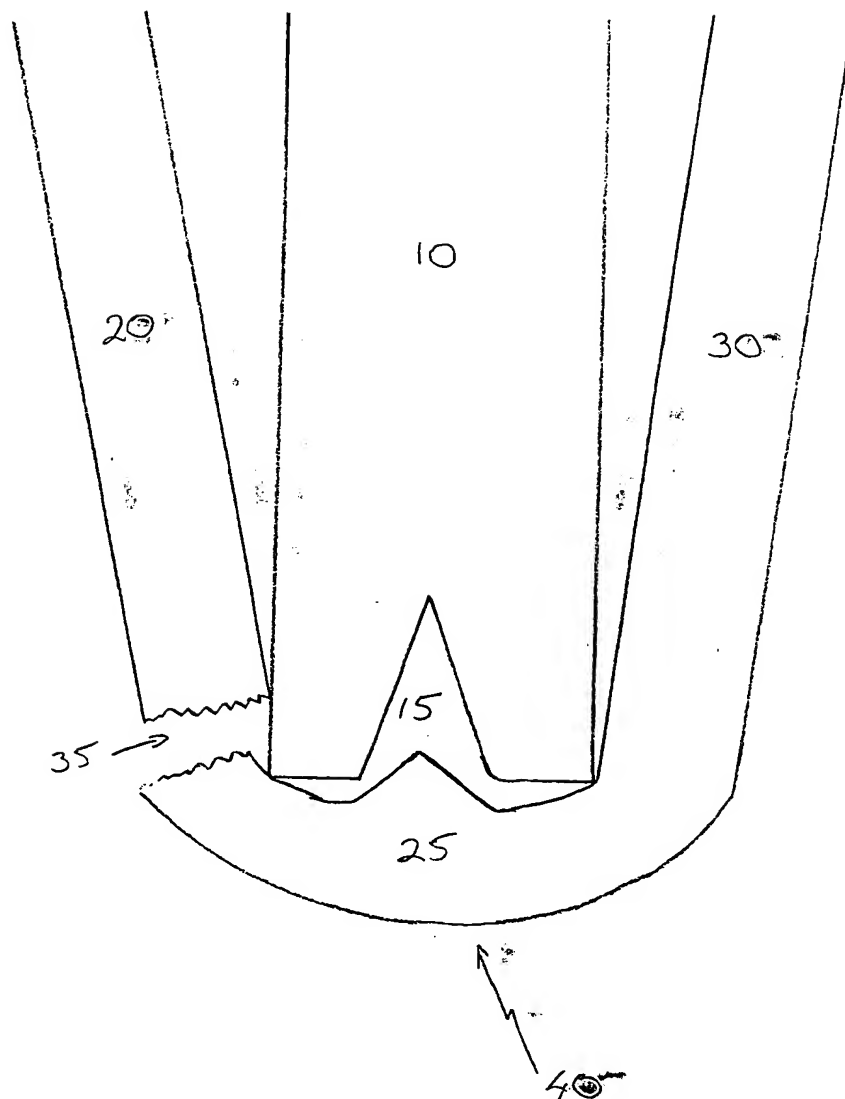


Fig 3

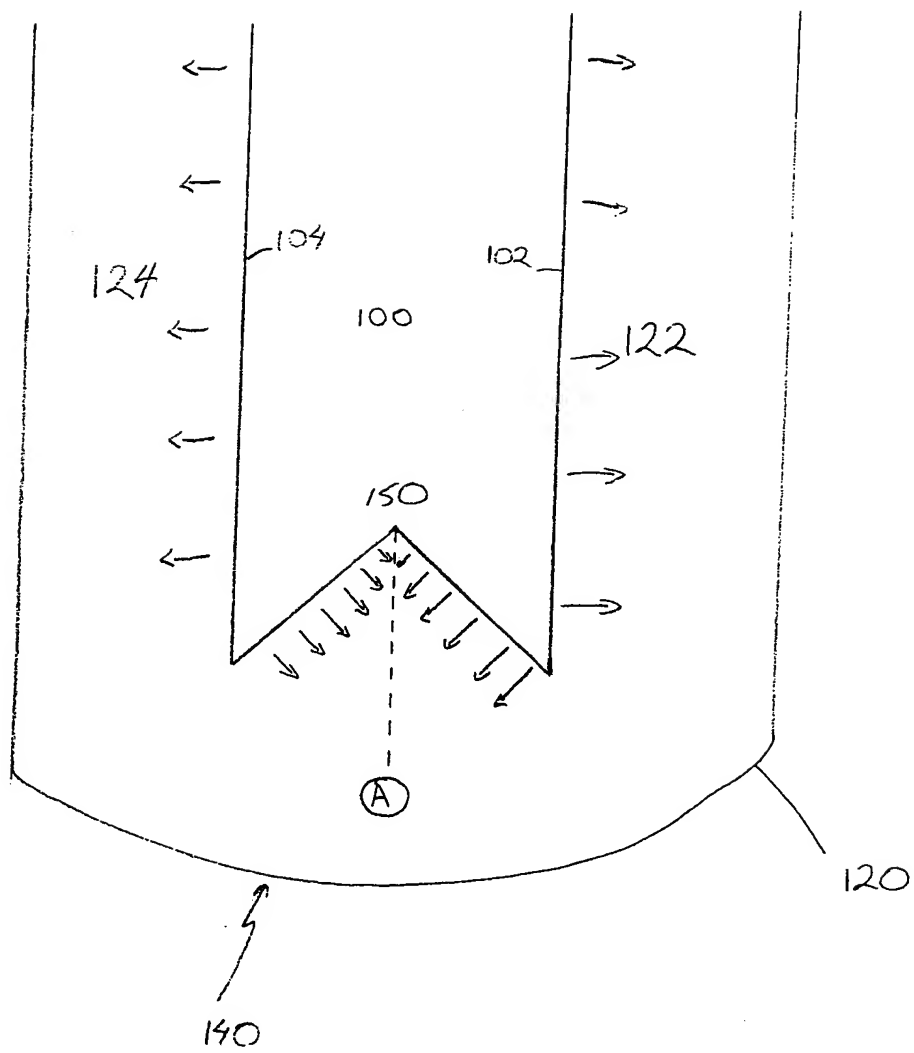


Fig 4.

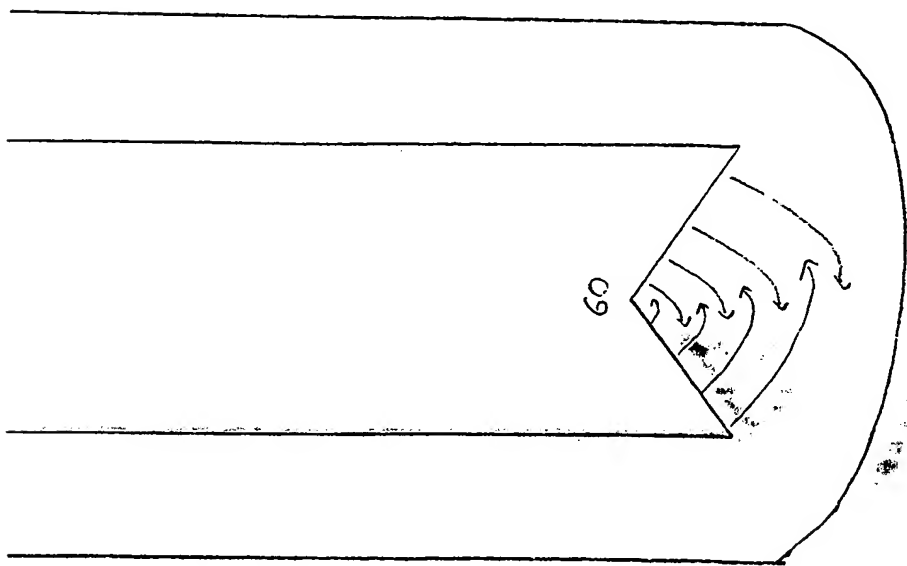


Fig 5

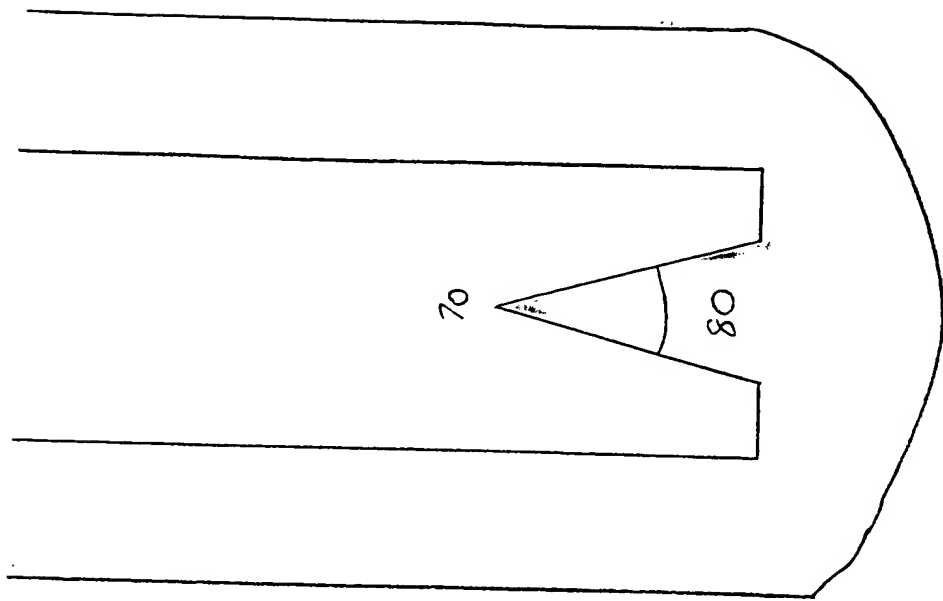


Fig 6